



2007 IEPR
**Overview of Aging Power Plant
Retirement/Replacement in
Scenario Analyses Project**

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Background

- This scenario project was designed to:
 - develop a greater understanding of the actions believed to be needed to achieve major reductions in greenhouse gases (GHG) for the electricity sector,
 - Understand at least some of the consequences of these actions on generation patterns, fuel use, costs, and
 - Permit some degree of tradeoff comparisons.



Status of Analysis

- Posted project documentation
 - Main Report, Appendices, and Excel spreadsheets for detailed results
 - Two Addendum Reports
- Workshops conducted 1/29, 6/18 and 7/9
- Further Analyses
 - Review of Additional Energy Efficiency Case(s)
 - Supplemental documentation



Supplemental Analyses

- Three elements of the original scope were delayed, but work is now complete or is still in process:
 - **Aging power plant retirements**
 - Impacts of lower power generation fuel consumption on natural gas market clearing prices
 - Water consumption for power generation
- As a result of the July 9 workshop, some limited additional analysis is underway

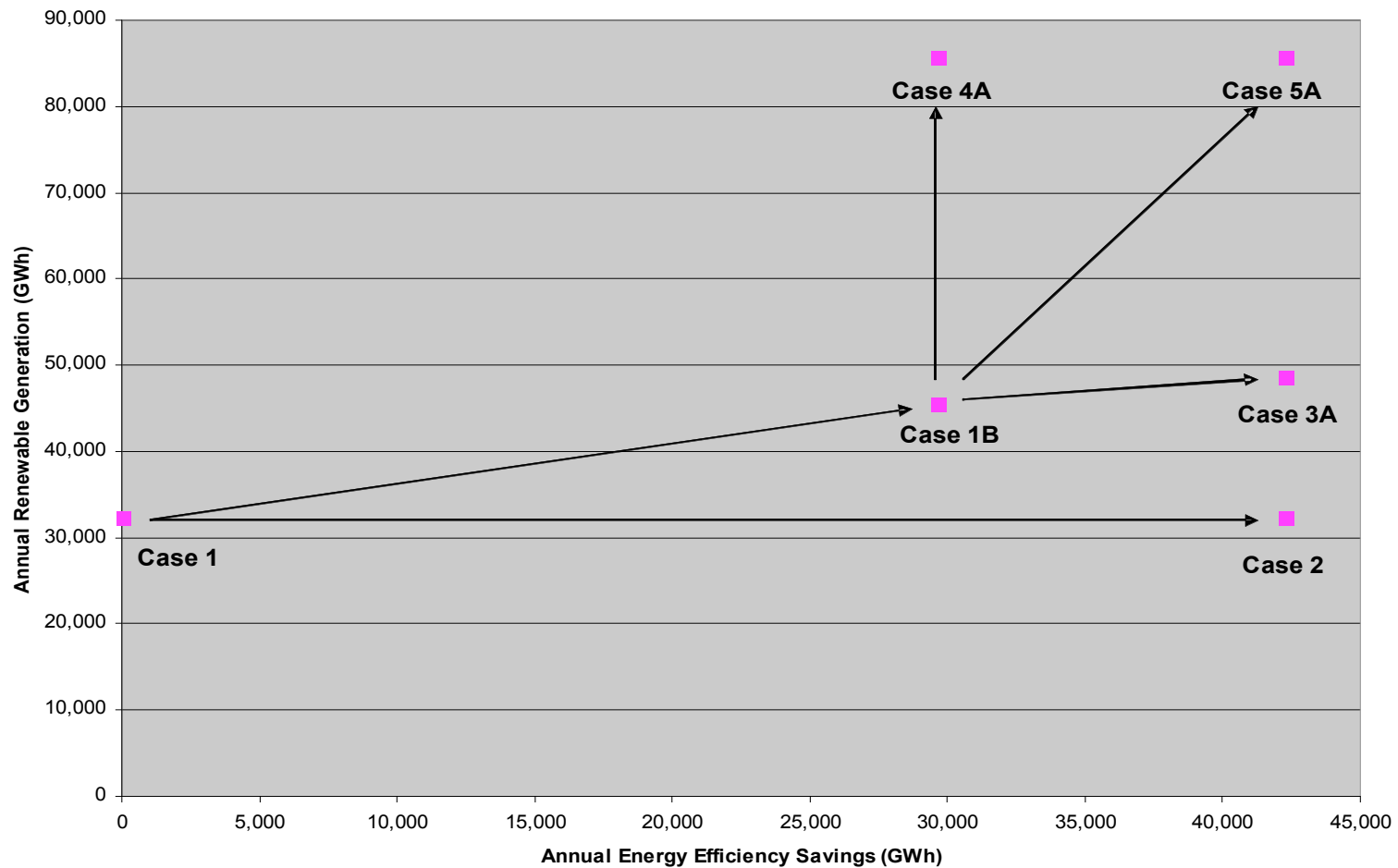


Thematic Scenarios Assessed

- Case 1 — Current conditions extended into the future.
- Case 1B — Compliance with current requirements.
- Case 2 — High sustained natural gas and coal prices.
- Case 3A — High energy efficiency in California only.
- Case 3B — High energy efficiency throughout the West.
- Case 4A — High renewables in California only.
- Case 4B — High renewables throughout the West.
- Case 5A — High energy efficiency and renewables in California only.
- Case 5B — High energy efficiency and renewables throughout the West.



Relationships Between Cases





Methodology

- Use Global Energy Decisions product called Market Analytics
 - Utilize large portions of Global's assumptions for WECC
 - Selectively replace certain elements
- Conduct power flow assessments or use other techniques to determine when/where transmission should be added
- Create integrating database for PROSYM results and additional calculations to facilitate comparisons
- Devise techniques to evaluate various sensitivity cases likely to be important to GHG emissions, costs, or reliability
- Evaluate sensitivity of results to uncertain inputs (fuel prices, "short-term shocks, etc.)
- Attempt to catalogue unquantified uncertainties



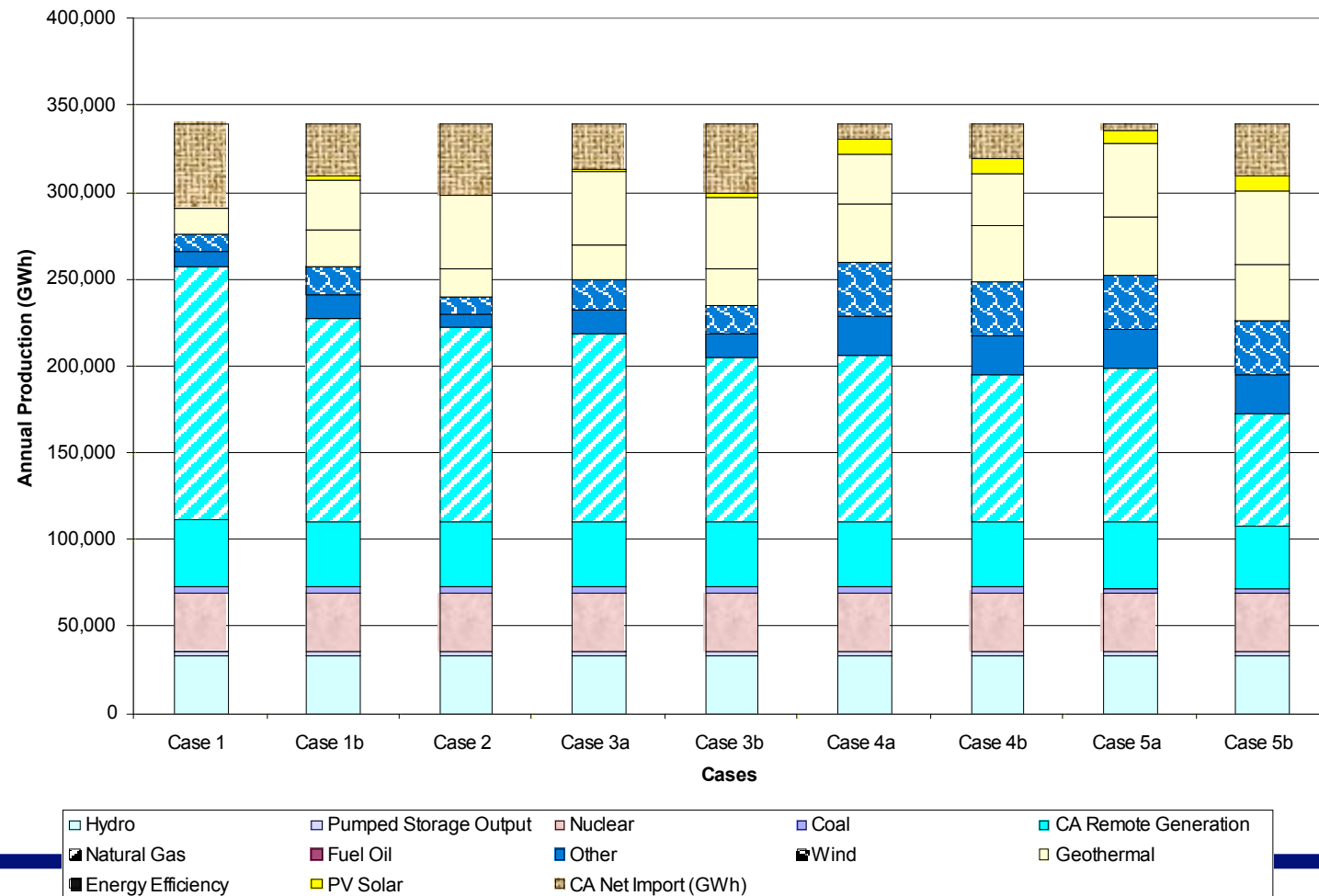
Original Results

- 55-year service life for the class of facilities identified as aging power plants
- No specific protocol for replacement of capacity to conform with local capacity requirements established by CPUC/CAISO
- Resource additions in each thematic scenario dominated by resources characteristic of the scenario



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Figure 6-3: Composition of Generation to Meet California Load in 2020





Aging Power Plant Policy

- “The Energy Commission recommends the following to ensure long-term contracts are signed that provide adequate electricity supplies for IOUs:
 - The CPUC should require that IOUs procure enough capacity from long-term contracts to both meet their net short positions and allow for the orderly retirement or repowering of aging plants by 2012.” (2005 *IEPR*, pp. 64-65.)



Aging Power Plant Study

- Original understanding of an assessment of implications of retirement policy
 - Retire facilities to match 2012 target year
 - Examine transmission implications of such retirements; as needed, identify upgrades and cost out
 - Rerun production cost models to determine consequences of such retirements in the format of the “scorecard” details reported earlier



Aging Power Plant Study

- Revised understanding of the scope of the study:
 - Replacement capacity has to be assessed along with transmission
 - Capacity additions will be at least partially different in conjunction with resource mix buildout
 - Retirement by 2012 creates timing issues with the buildout timeline for energy efficiency and renewables
 - Local capacity requirements adopted by the CPUC and CAISO constrain choices



Aging Power Plant Study

- Final assessment design:
 - Limit analysis to SCE transarea
 - Link replacement capacity directly to each of the key scenario strategies
 - Examine both 2012 and phased retirement assumptions
 - Attempt to reflect local capacity requirements in identifying replacement capacity



Implementation of the Study

- Navigant Consulting:
 - conducted the retirement study in conjunction with scenario team
 - Extensive meetings between Navigant transmission team and the scenario team
 - Common assumptions used in load flow analyses and production cost modeling wherever possible
- Global Energy:
 - used the results of Navigant's load flow assessments to revise the input datasets for the cases
 - Ran the production cost model to obtain results comparable to other cases in the Scenario Project



Results

- The results are a series of variations on Case 1B, 3A and 4A
- A change in the generation mix:
 - leads to a change in predicted generation output and imports
 - These changes affect the SCE transarea and all other transareas exporting to or importing from SCE transarea
 - Transmission costs increase
 - Increases GHG emissions for power plants within California, but decreases GHG on a “California responsibility” basis



Overview of Alternative Assessments

	Original (June Report)	2012 Retirements	Phased Retirements
Case 1 (Cur Trends)	Ret: 3,700 by 2020 New: 1,100 by 2020	NA	NA
Case 1B (Curr Reqs)	Ret: 3,700 by 2020 New: no thermal	Ret: 4,140 in 2012 New: 6,832 by 2020	Ret: 4,140 by 2020 New: 6,834 by 2020
Case 3A (High EE)	Ret: 3,700 by 2020 New: no thermal	Ret: 4,140 in 2012 New: 5,888 by 2020	Ret: 4,140 by 2020 New: 5,709 by 2020
Case 4A (High renewables)	Ret: 3,700 by 2020 New: no thermal	Ret: 4,140 in 2012 New: 6,183 by 2020	Ret: 4,140 by 2020 New: 4,612 by 2020



Cumulative Transmission Costs by 2020 (Table 2, \$2006 million)

Scenario	Original	2012 Ret.	Phased Ret.
Case 1B	1,700	2,029	2,029
Case 3A	1,700	2,029	2,029
Case 4A	2,200	2,529	2,529



Imports/Exports

- Table 4 reports details of the revised assessment compared with the original:
 - Imports into SCE decrease
 - Exports out of SCE increase
 - Net Imports into SCE decrease substantially
- No substantial changes in relative differences among the three cases for either retirement variant



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GHG (Extract from Table 6)

Scenario	Original	2012 Ret.	Phased Ret.
Case 1B			
CA plants	63,907	65,629	65,677
CA Respons.	107,976	106,668	106,752
Case 3A			
CA plants	60,032	62,071	61,749
CA Respons.	101,652	100,532	100,599
Case 4A			
CA plants	58,078	59,681	59,063
CA Respons.	89,891	89,267	89,416



Documentation

- The staff report called “Second Addendum” provides an overview of the analysis
- An appendix prepared by Navigant documents the retirement and replacement cases, the transmission upgrades, and the supporting analyses
- An appendix prepared by Global Energy provides further details on the production cost results



Validation of Study

- Limited interactions with CAISO and SCE
- CAISO provided suggestions about contingency assessment to better coordinate with approach used for LCR studies
- SCE transmission planning unit provided some important clarification about:
 - recent transmission line rating changes
 - the limiting elements of key transmission lines
- Both reviewed draft report as “sanity check.”



Conclusions & Next Steps

- Navigant's work is a credible start to an extremely complex topic
- As in any "what if" scenario assessment, the results are conditional and do not directly lead to an unambiguous set of "action steps"
- Further review of the retirement, repowering and replacement of these facilities is required
- CAISO has already proposed a broad transmission Study Plan approach for retirements, and that forum may be the next step in refining this analysis
- 2007 IEPR Committee needs to consider what direction, if any, it wants to provide on this topic



Further Presentations

- Navigant will provide a detailed presentation on its retirement/replacement and transmission analysis using load flow analyses
- Staff and Global Energy are available to answer questions about the production cost model results